

CLAIMS

We claim:

- 1 1. A waveguide comprising:
2 at least one outer surface defining a waveguide cavity; and
3 at least one inner surface positioned within said waveguide cavity, wherein said
4 inner surface comprises a frequency selective surface (FSS) having a plurality of
5 frequency selective surface elements coupled to at least one substrate, said substrate
6 defining a first propagation medium such that an RF signal having a first wavelength in
7 said first propagation medium can pass through said frequency selective surface;
8 wherein said frequency selective surface is coupled to a second propagation
9 medium such that in said second propagation medium said RF signal has a second
10 wavelength which is at least twice as long as a physical distance between centers of
11 adjacent ones of said frequency selective surface elements.
- 1 2. The waveguide of claim 1, wherein said second wavelength is different than
2 said first wavelength.
- 1 3. The waveguide of claim 1, wherein said substrate comprises a dielectric having
2 at least one of a relative permittivity and a relative permeability which is greater than 3.
- 1 4. The waveguide of claim 1, wherein said frequency selective surface comprises
2 a plurality of dielectric layers.

1 5. The waveguide of claim 1, wherein said frequency selective surface comprises
2 at least one dielectric layer for matching an impedance of said first propagation
3 medium to an impedance of said second propagation medium.

1 6. The waveguide of claim 1, wherein said frequency selective surface elements
2 comprise apertures in a conductive surface.

1 7. The waveguide of claim 1, wherein said frequency selective surface elements
2 comprise conductive elements.

1 8. An antenna for microwave radiation comprising:
2 a first horn; and
3 at least a second horn positioned within said first horn, said second horn
4 comprising at least one frequency selective surface having a plurality of frequency
5 selective surface elements coupled to at least one substrate, said substrate defining a
6 first propagation medium such that an RF signal having a first wavelength in said first
7 propagation medium can pass through said frequency selective surface;
8 wherein said frequency selective surface is coupled to a second propagation
9 medium such that in said second propagation medium said RF signal has a second
10 wavelength which is at least twice as long as a physical distance between centers of
11 adjacent ones of said frequency selective surface elements.

1 9. The antenna of claim 8, wherein said second wavelength is different than said
2 first wavelength.

1 10. The antenna of claim 8, further comprising at least a third horn positioned within
2 said second horn, said third horn comprising at least one frequency selective surface.

1 11. The antenna of claim 8, wherein said substrate comprises a dielectric having at
2 least one of a permittivity and a permeability which is greater than 3.

1 12. The antenna of claim 8, wherein said frequency selective surface elements
2 comprise apertures in a conductive surface.

1 13. The antenna of claim 8, wherein said frequency selective surface elements
2 comprise conductive elements.

1 14. The antenna of claim 8, wherein said frequency selective surface comprises a
2 plurality of dielectric layers.

1 15. The antenna of claim 8, wherein said frequency selective surface comprises at
2 least one dielectric layer matching an impedance of said first propagation medium to
3 an impedance of said second propagation medium.

1 16. A waveguide horn antenna comprising,

2 a tapered hollow metallic conductor; and
3 a frequency selective surface comprising a substrate and an array of elements
4 defining at least one wall of said horn, said frequency selective surface positioned for
5 confining and guiding a propagating electromagnetic wave;
6 said substrate having at least one of a permeability and a permittivity greater
7 than about three.

1 17. The waveguide horn antenna according to claim 16 wherein said frequency
2 selective surface is comprised of concentric ring slots.

1 18. A method for improving performance in a horn antenna comprising the steps of:
2 forming at least one wall of said horn antenna of a frequency selective surface;
3 and
4 selectively reducing at least one grating lobe of said antenna by increasing at
5 least one of a permittivity and a permeability of a substrate comprising said frequency
6 selective surface to a value greater than three.

1 19. The method according to claim 18 further comprising the step of increasing said
2 value of at least one of said permeability and said permittivity to between about 10 and
3 100.

- 1 20. The method according to claim 18 further comprising the step of reducing at
- 2 least one grating lobe of said antenna by decreasing a spacing between adjacent
- 3 elements of said frequency selective surface.